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NEW AMERICAN MEINERTELLIDAE (ARCHAEOGNATHA, MACHILOIDEA)

HELMUT STURM[1] AND CARMEN BACH DE ROCA[2]
[1]Department of Biology, University of Hildesheim,
D-3200 Hildesheim, Germany
[2]Department of Animal Biology, Faculty of Sciences,
University of Córdoba, 14004, Córdoba, Spain

Abstract.—*Praemachilellus* NEW GENUS and its type-species *P. rentzii* NEW SPECIES from Mexico are described. The genus *Machilinus* Silvestri, 1905 is redescribed and subdivided into the three subgenera *Machilinus* s. str., *Neotropolinus* NEW SUBGENUS and *Nearctolinus* NEW SUBGENUS. *Machilinus* (*Neotropolinus*) *chilensis* NEW SPECIES and *Machilinus (N.) abulbiferus* NEW SPECIES are described; *M. (N.) chilensis* is the first species of *Machilinus* for Chile. *Machilinus* (*Nearctolinus*) *aurantiacus* (Schött), 1896 from western United States is redescribed and *M.* (*N.*) *a. setosus* NEW SUBSPECIES is described. The phylogenetical relations of the taxa are briefly discussed.

Key Words.—Insecta, Arachaeognatha, Microcoryphia, Meinertellidae, *Machilinus, Praemachilellus*

With approximately 450 described species the Archaeognatha (= Microcoryphia) constitute a relatively small order of the primary apterous insects. The recent representatives are subdivided into two families: the more primitive Machilidae, which are centered mainly in the northern hemisphere, and the more derived Meinertellidae, which are predominantly distributed over the southern hemisphere. In North America and Mexico, both families occur.

In attempting to clarify the phylogenetic relations within the genera of recent Archaeognatha, it became apparent that the widely distributed genus *Machilinus* had not been adequately described. With the inclusion of the South American and North American *Machilinus,* it was necessary to redescribe the genus and to subdivide it into three subgenera. In material received from Mexico, specimens of a new genus were found, the females of which have ovipositors with setae that were strongly thickened in part, a characteristic that up to now has been restricted to the genus *Kuschelochilis* within the Meinertellidae. The results presented here indicate that our knowledge of the American fauna (sensu New World) of Meinertellidae is still insufficient, in spite of the excellent studies of Wygodzinsky (1950, 1951, 1952, 1967, 1974) and Wygodzinsky & Schmidt (1980).

MACHILINUS SILVESTRI, 1905: 2

Type Species.—*Machilis rupestris* Lucas, 1846: 253.

Redescription.—Small (body length 6–9 mm, rarely 10 mm); hypodermal pigment brown, often unclearly defined; scales absent on head, head appendages, legs and stylets. Head: frons not protruded; eyes very large (ratio width of eyes : width of head, 0.8–0.9), about as long as wide; lateral ocelli sublateral to eyes, in alcohol hyaline, elliptical, ovoid or round; setae on clypeus small to medium sized; frons of males often with strong spine-like setae. Antennae: shorter than the body, generally exceeding one-half body length; flagellum uniformly brown, distal chains generally with eight to nine subarticles. Mandibles: distal end distinctly four-toothed, apex of teeth generally black. Maxillae: apex of terminal teeth of lacinia generally black; longitudinal process near dorsal base of maxillary palp

absent; triangular process on article one of palp well developed, quite digitate; article seven very short; article two of male palp on the distal dorsal border with a hooked process typical in Meinertellidae; inner face of article two or two + three of males with specialized setae (sometimes also the shape of these articles sexually dimorphic). Labium: submentum near base of palps slightly protruded laterad; labial palp article two on dorsal side with almost transversely oriented setae; distal portion of article three only slightly widened, in male often of special form, with field of short setae. Legs: coxal stylets absent; femur I distinctly wider than II and III; ventral margin of all legs from femur distadly with brown or black spine-like setae. Urosternites: sternites I–VII very small (usual in Meinertellidae); spine-like setae on coxites absent; stylets on II–IX present, apex with a tuft of dark setae, terminal spines well developed, partially reduced or completely reduced depending on subgenus; one + one coxal vesicles on II–VII or only on II–V depending on subgenus. Penis: shorter than one-half the length of coxites IX, aperture ventral, triangular; inner margin of aperture with slightly specialized small setae that present a grooved basal part; parameres absent. Ovipositor: long and slender, of primary type, surpassing tips of stylets IX, with more than 55 articles; terminal spines longer than the two to three distal articles; distal articles one to three of each gonapophysis with two to nine sensory rods or small setae; more proximal articles with highly reduced characteristic chaetotaxy, maximum of three setae per article; lateral macrochaetae present on each second or third article of distal one-third to one-half of each gonapophysis present. Caudal appendages: typical hair-like scales absent; cerci with single terminal spine.

Discussion.—*Machilinus* is distributed worldwide: southern Europe to southern European Russia, North Africa, Cape Verde Islands, South Africa, western North America, Argentina and Chile. The genus represents a monophyletic group. This is indicated by the combination of the following characteristics common to this group (apomorphies marked by [A]): eyes very large; lateral ocelli sublateral, round to elliptical and hyaline to light red [A]; apex of teeth on mandible and lacinia generally black [A]; horizontal process on the base of maxillary palp absent [A]; article two of labial palp on dorsal side with distinctly transversely oriented setae [A]; coxal stylets absent from all legs; penis with slightly specialized inner setae; highly reduced chaetotaxy with lateral macrochaetae distributed at odd intervals on gonapophyses VIII and IX [A]. These characteristics indicate not only the natural relationship of the group but also its special position within the Meinertellidae. Its relationship with other genera of the family is not clear. In spite of the many derived characteristics, the worldwide distribution indicates that the genus existed for quite a long time. Those groups that are geographically very far apart have obviously evolved separately and should be subgenera.

Subgenus *Machilinus* s. str.

Type Species.—*Machilis rupestris* Lucas, 1846: 253.

Description.—Terminal spines of abdominal stylets II–IX well developed, distinctly longer than surrounding pigmented setae; distance between inner basal margins of abdominal stylets II and IV not very different, ratio distance IV:II, <1.4; one + one coxal vesicles on abdominal coxites II–VII present.

Discussion.—The normally developed terminal spines on abdominal stylets represent plesiomorphic characteristics within the Meinertellidae (see Sturm 1984). Silvestri (1905) indicates the type-species of *Machilinus rupestris* has coxal vesicles on the abdominal coxites I–VII. The examination of more than ten European and North African species proved that they lack coxal vesicles on abdominal segment I. This, and the reduction of coxal vesicles only on abdominal segment I, indicate that this subgenus is the most primitive of the three subgenera. It includes not only the European and North African species (16) but also the species from Yemen

(1), South Africa (1) and the Cape Verde Islands (1) (Wygodzinsky 1967, Mendes 1981).

Material Examined.—*Machilinus* (*M.*) *rupestris gallicus* Bitsch, 1967: FRANCE. *CORSICA:* Porticcio, 5–15 Aug 1982, M. Bless, 2 males, 2 females.

M. (*M.*) *kleinenbergi* (Giardina), 1900: ROMANIA. nr Histria, 12 Sep 1969, H. Sturm, 2 females.

Neotropolinus Sturm & Bach, NEW SUBGENUS

Type Species.—*Machilinus chilensis* NEW SPECIES.

Description.—As subgenus *Machilinus,* except: terminal spines on all abdominal stylets almost completely reduced, replaced by a tuft of pigmented setae; one + one coxal vesicles on abdominal coxites II–VII present.

Diagnosis.—*Neotropolinus* can be distinguished by its reduced terminal spines of all abdominal stylets (a tiny hyaline remainder—compare Figs. 23, 24—discernible) which have been replaced by a tuft of pigmented setae. It also differs from the subgenus *Nearctolinus* in the coxal vesicles on abdominal coxites II–VII.

Etymology.—The subgenus is named after the biogeographical region, the Neotropics, where the group is found.

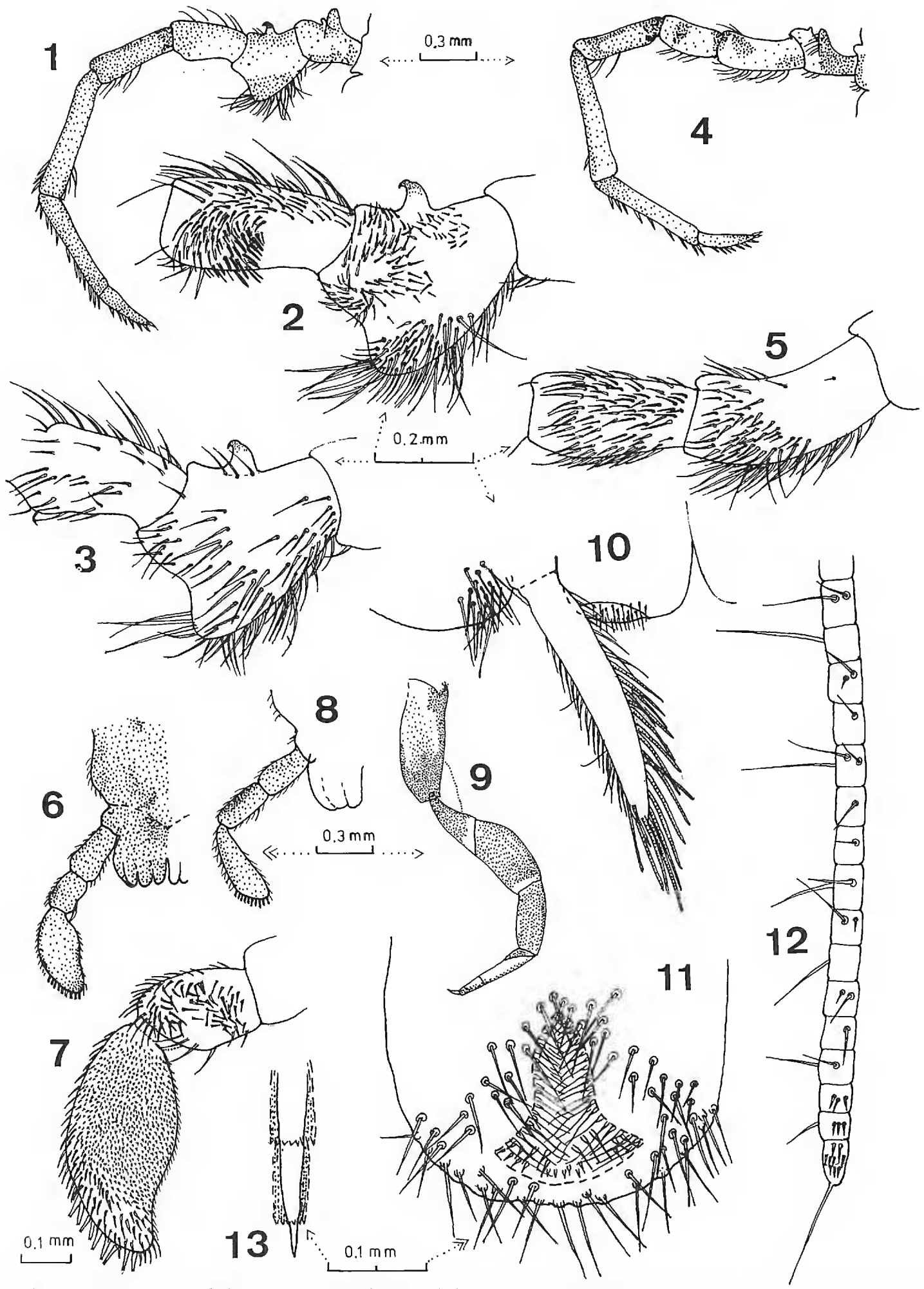
Discussion.—The almost complete reduction of the terminal spines on all abdominal stylets in all South American species of the genus is a unique characteristic within the recent Archaeognatha. It indicates that *Neotropolinus* is more derived than the subgenus *Machilinus. Neotropolinus* comprises six known species from Argentina and Chile (see discussion under *M.* (*N.*) *chilensis* Sturm & Bach NEW SPECIES).

Material Examined.—See *Machilinus* (*N.*) *chilensis* NEW SPECIES and *M.* (*N.*) *abulbiferus* NEW SPECIES.

Machilinus (*Neotropolinus*) *chilensis* Sturm & Bach, NEW SPECIES

Types.—Holotype: male; data: CHILE, nr Valdivia, fundo Zimmermann, base of *Nothofagus dombeyi* trunk, 9 Apr 1989, W. Probst. Allotype: female; same data as type. Holotype and allotype deposited in Zoological Museum of the University, Hamburg. Paratypes: 2 males, same data as type; 3 females above Valdivia, rancho Dr. Martin, forest, on bark of fallen trunk, 13 Apr 1989, W. Probst; deposited in Sturm collection, Hildesheim.

Description.—Body length 6–8 mm; hypodermal pigment yellow to dark brown, very extended on head, mandibles, labium, scapus, pedicellus, legs and some coxites, patches often not clearly defined; black chitinous pigment on apex of mandible on flagellum of antenna and on all spine-like setae. Head: nearly all frontal area more or less densely pigmented; frons and clypeus with medium to small sized setae; eyes in frontal view somewhat longer than wide (ratio width of eyes : width of head approximately 0.9; ratio length of eyes : width, 1.2; ratio line of contact : length of eye, 0.7–0.8); lateral ocelli in alcohol white, sublateral to eyes, ovoid to subrectangular, distance of inner borders 0.5–0.6 × width of both eyes. Antennae: shorter than body (up to 6 mm long); chains of flagellum with up to nine subarticles; scapus about 2 × as long as wide; pedicellus somewhat shorter than wide. Maxillary palps (Figs. 1–5): ratio length of articles seven to four, 0.45–0.5:1.0:1.05–1.15:0.75–0.8 respectively; number of dark-tipped spines on articles seven to five, up to 12, 21, 2, respectively; distribution of hypodermal pigment as in Figs. 1 and 4; highly sexually dimorphic: article two (male) ventrally strongly protruded, with long straight setae, inner side with ring of medium-sized setae oriented differently; article three (male) inner side with characteristic field of setae, partially black and thick. Labium (Figs.



Figures 1–13. *Machilinus* (*Neotropolinus*) *chilensis* NEW SPECIES. Figures 1–3. Maxillary palp (male), lateral view. Figure 1. Survey. Figure 2. Articles 2 + 3, inner side. Figure 3. Outer side. Figures 4, 5. Maxillary palp (female), lateral view. Figure 4. Survey. Figure 5. Articles 2 + 3, inner side. Figures 6–8. Labium in part, dorsal view. Figure 6. Male. Figure 7. Articles 2 + 3 of male palp with transversal setae on article 2 and field of short setae on article 3. Figure 8. Female. Figure 9. Leg I (female). Figure 10. Urosternite II (male), partly. Figure 11. Apex of penis, ventral view. Figure 12. Gonapophysis VIII (female), distal part. Figure 13. Apex of cercus (female) with terminal spine.

6–8): palps sexually dimorphic; article two (male) much shorter (ratio length of article two : one, 0.8 (males), 1.0–1.1 (females)), with group of characteristically oriented setae dorsally; article three (male) flattened, of special form, upper side with proximal field of setulae covering more than two-thirds of area. Legs (Fig. 9): nearly all surface pigmented, pigment concentrations on coxae and trochanters; maximal number of spine-like setae on femur, tibia, tarsomeres is 21, 35, 16, 24, 10 respectively; trochanters with few spine-like setae or with transitional setae. Urosternites (Fig. 10): with diffuse yellow-brown pigment on most of surface; coxites II–VII each with one + one coxal vesicles; coxites II–VIII lateradly of stylet base with well limited group of straight setae, more setae on anterior segments; stylets with characteristic black spine-like setae on median margin, their length increasing apically, forming tuft near tip, terminal spine not discernible; median margin of stylets II characteristically curved; ratio length of coxites : length of stylets for II and VIII, 1.2–1.5:1.0; for V, 1.7:1.0 (male); for IX, 1.3–1.5:1.0 (male); 1.6–1.8:1.0 (female); ratio length of terminal tuft : length of stylet, 0.2–0.4. Penis (Fig. 11): aperture rounded by ring of long straight setae; lateral inner border with row of setae that are slightly grooved on base, and ends of which cross; apical border with one or two rows of shorter grooved (?) setae. Ovipositor (Fig. 12): very long (up to 3.6 mm), slender; with >60 articles (see also description of genus). Caudal appendages (Fig. 13): with black spine-like setae; hair-like scales absent; one long terminal spine on cerci present.

Diagnosis.—*Machilinus chilensis* can be distinguished from the other species of the subgenus by the combination of the following characteristics: the extremely protruded ventral margin of article two of the male maxillary palp, the characteristic chaetotaxy of its articles two and three; the very short article two of the male labial palp and the specific pigment pattern on maxillary and labial palps as well as on leg I.

Discussion.—The new species is the first one of the genus that is clearly identified as coming from Chile. Wygodzinsky (1967: 508, 510) indicates the presence of the genus in Chile, but this information is not supported either by species names or by localities. The ventrad projection on article two of the male maxillary palp and the specialized setae on this article indicate that *M.* (*N.*) *chilensis* is closely related to four other South American species: *M.* (*N.*) *birabeni* Wygodzinsky, 1944, *M.* (*N.*) *inopinatus* Wygodzinsky, 1952, *M.* (*N.*) *muntanolae* Wygodzinsky, 1950 and *M.* (*N.*) *neotropicalis* Wygodzinsky, 1944, all collected in Argentina. Similar sexually dimorphic characters are also present in some European species (cf. *M.* (*M.*) *cisatlanticus* Janetschek, 1953, *M.* (*M.*) *rocai* Bach, 1975, *M.* (*M.*) *valencianus* Mendes & Bach, 1981). In the European species the ventral projection on article two is distinctly less pronounced. In *M. abulbiferus* NEW SPECIES from Argentina, the ventral projection on article two of the male maxillary palps is absent. The description of *M. pampeana* (Silvestri 1902) is insufficient and, therefore, must be regarded as a nomen nudum. Wygodzinsky (1950: 597) mentions in the case of *M. birabeni* two terminal spines on cercus, a trait that is generally considered to be characteristic of the genus. However, in all American specimens of *Machilinus* with well preserved cerci only a single terminal spine was present. Sometimes a tiny and indistinct projection on the base of the larger one could be suggested. The peculiar form of article three of the male labial palp, and the setulae on this article, are described by Wygodzinsky (1944: 90, 91) for *M. neotropicalis*. He illustrated a similar form of article three for males of *M. muntanolae* and *M. inopinatus* (Wygodzinsky 1950: 599, 1952: 438). The presence of grooved setae around the aperture of the penis is mentioned in this paper for the first time, but these could also be encountered in North American and European species and they are probably characteristic of the genus.

Material Examined.—See types.

Machilinus (*Neotropolinus*) *abulbiferus* Sturm & Bach, NEW SPECIES

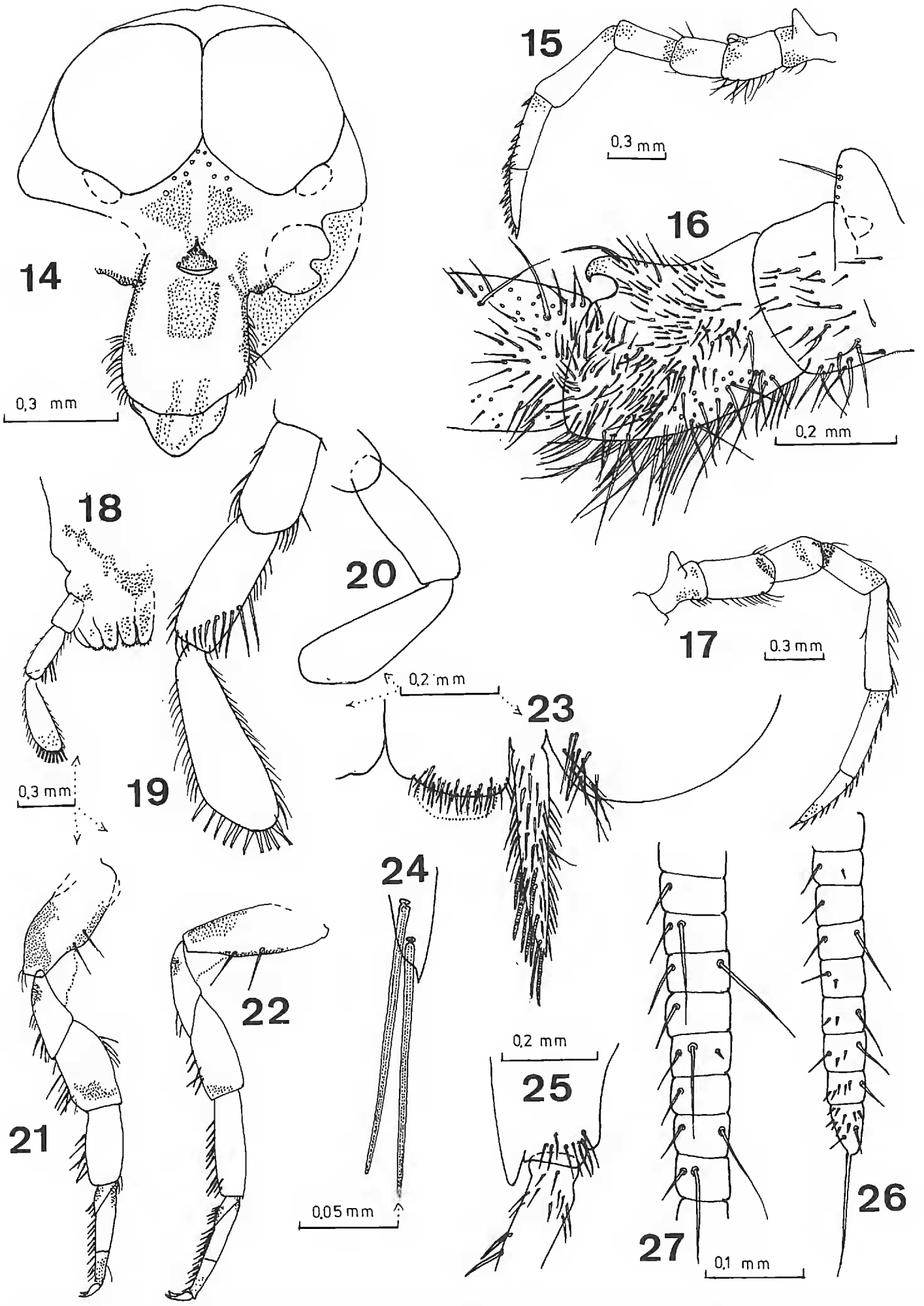
Types.—Holotype: male; ARGENTINA. *CATAMARCA:* El Manchado, 4000 m, Jan 1958, Goldbach. Allotype: female; same data as holotype. Holotype and allotype deposited in the American Museum of Natural History, New York.

Description (for characters not mentioned see *M. chilensis* or the genus description).—Body length approximately 6.5–8.0 mm, brown hypodermal pigment scarcely developed. Head (Fig. 14): two conspicuous triangular patches of pigment on frons; setae on clypeus small to medium sized; ratio width of eyes : width of head, approximately 0.83; length of eyes : width, 1.1–1.2; line of contact : length of eye, 0.5–0.6; lateral ocelli ovoid, not clearly defined. Antennae: up to 5 mm; terminal chains with eight subarticles; scapus and pedicellus conspicuously stout (ratio length : width of scapus, 1.4–1.5, of pedicellus = 0.60–0.75); scapus with distinct, longitudinal stripe of hypodermal pigment. Maxillary palps (Figs. 15–17): ratio length of articles seven : six : five : four = 0.72:1.0:1.2:0.86 (male); 0.62:1.0:1.1:0.73 (female); number of spines with brown colored tips on articles seven/six/five is 9–11/12–13/–; for distribution of hypodermal pigment see Figs. 15 and 17; distinctly sexually dimorphic; article two of male with the usual hook-shaped process near dorsal distal end, on ventral border with many long strong setae, median side with field of medium-sized slightly curved setae forming a whirl on distal part; ventral border not distinctly protruded, comparable field on article two of female absent. Labium (Figs. 18–20): article two of palp in male not distinctly shorter than in female, article three distally only slightly widened, not obviously sexually dimorphic, setulae absent. Legs (Figs. 21, 22): coxae with big patches of hypodermal pigment, trochanters and femora with smaller ones; more distal articles indistinctly pigmented; typical medium-sized spine-like setae on all tarsomeres present, tibiae and femora with longer ones and with transitional setae; all types of spine-like setae light brown; maximum number of spine-like setae (without transitional forms) on trochanter, femur, tibia and the three tarsomeres, 3/11/22/10/14/8 respectively. Urosternites (Figs. 23–25): coxites II–VII with well defined fields of straight setae near base of all coxal vesicles and lateradly from stylet base; coxites IX with group of setae proximadly from stylet base; spine-like setae on coxites absent; long scattered setae especially on coxites I–III; spine-like setae on stylets brown to black; ratio length of coxite : length of stylet for II, 1.35–1.5, for V, 2.4–2.5, for VIII, 1.4–1.5, for IX 1.65–1.75. Penis: no striking differences when compared to that of *M. chilensis*. Ovipositor (Figs. 26, 27): general chaetotaxy quite similar to *M. chilensis*: up to three longer setae per article, interrupted taxy of lateral macrochaetae; slight differences in number and position of sensory rods. Caudal appendages: length of terminal filament of male 6 mm, cerci 3 mm; cerci with long terminal spine in the base of which perhaps a very short one.

Diagnosis.—*M. abulbiferus* is distinguished from all other five species of the subgenus *Neotropochilis* by the absence of a distinct projection on the ventral margin of article two on the male axillary palp and by the different distribution and the lower intensity of hypodermal pigment, especially on head maxillary palps and legs. It is also distinguished apparently by the very stout form of scapus and pedicellus; the form of article three of the male labial palp does not differ from that of the female and lacks setulae.

Etymology.—The species name refers to the absence of a projection on the ventral margin of article two of the male maxillary palp. a (greek), alpha privativum; bulbus (latin), bulb, rounded projection; fere (latin), bear.

Discussion.—A distinctly sexually dimorphic form and chaetotaxy were described for four of the other South American species of the genus. In the fifth species (*M. birabeni*) this characteristic needs to be examined. The absence of distinctly specialized setae on article three of the male maxillary palp of *M. abulbiferus* is in common with *M. chilensis*. *M. abulbiferus* was found at the highest altitude registered for Meinertellidae. In the tropical region of South America species of *Neomachilellus* and *Meinertellus* (Meinertellidae) are found at heights



Figures 14–27. *Machilinus* (*Neotropolinus*) *abulbiferus* NEW SPECIES. Figure 14. Head (female), frontal view. Figures 15–17. Maxillary palp, lateral view. Figure 15. Survey (male). Figure 16. Article 2 (male), median side with hook. Figure 17. Survey (female). Figures 18–20. Labium and labial palp, ventral view. Figures 18, 19. Female. Figure 20. Male. Figure 21. Leg I (female). Figure 22. Leg III (female). Figure 23. Detail of coxites II with stylet (female), ventral view. Figure 24. Tip of stylet II (female). Figure 25. Distal end of stylet IX with base of stylet (female), ventral view. Figure 26. Apex of gonapophysis VIII (female), ventral view. Figure 27. Gonapophysis VIII (female), articles adjacent to Figure 26.

of up to 3500 m (Sturm 1984: 37). In contrast, *Machilanus swani* Wygodzinsky, 1974 was found at heights above 5700 m in the Himalayas.

Material Examined.—See types.

Nearctolinus Sturm & Bach, NEW SUBGENUS

Type Species.—*Machilis aurantiacus* (Schoett), 1897.

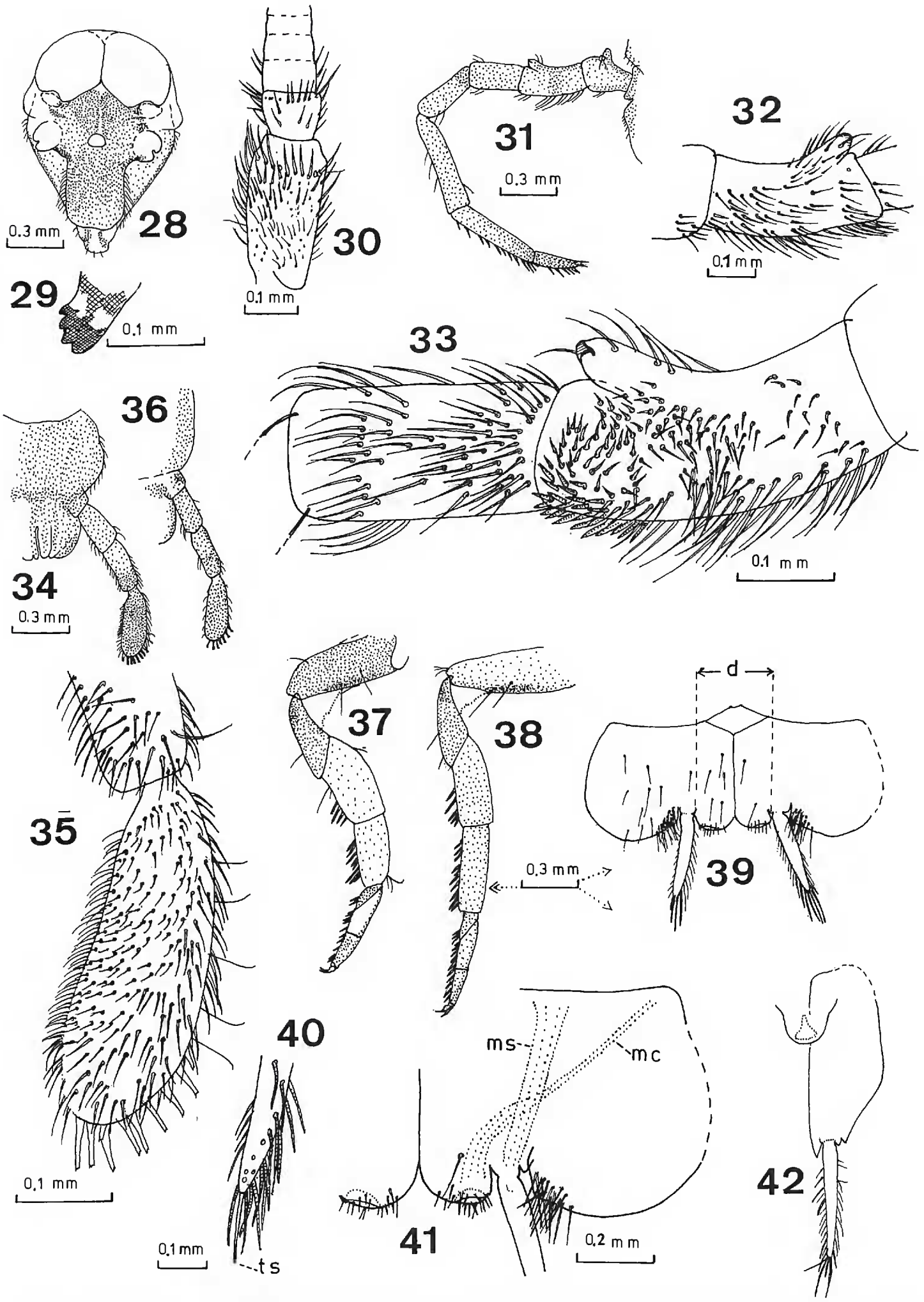
Description.—As subgenus *Machilinus,* except: a reduced form of one + one coxal vesicles on abdominal coxites II–V present; slightly pigmented terminal spines on abdominal stylets II and III well developed, a little longer than surrounding heavily pigmented setae, terminal spines on stylets IV–IX greatly reduced (Fig. 44); difference in distance between median margins of abdominal stylet bases II and IV very great; ratio distance on IV : distance on II, >1.8.

Diagnosis.—*Nearctolinus* can be distinguished from the other subgenera by its: complete reduction of coxal vesicles on abdominal segments I, VI and VII, and reduction of vesicles on II–V; the reduction of terminal spines on abdominal stylets IV–IX and reduction of the inner distance between abdominal stylets II + III are also unique.

Etymology.—The subgenus is named after the biogeographical region, the Nearctic, where the group is found.

Discussion.—The apparently complete reduction of coxal vesicles on abdominal segments I, VI and VII, the reduction of size of vesicles on II–V, the reduction of terminal spines on abdominal stylets IV–IX, as well as the obvious reduction of the inner distance between abdominal stylets II + III, prove that the subgenus *Nearctolinus* is the most derived of the three subgenera. None of the many alcohol-fixed specimens examined had swelled a coxal vesicle, a common case in other genera. Therefore, it is doubtful if the vesicles are still exsertile. The main criterion for the existence of vesicles on segments II–V is morphological: the presence of the retractor muscle (Figs. 41, 43), and of a double lined outer border. By the same criterion, *Kuschelochilis ochagaviae* Wygodzinsky, 1951, a species that according to Wygodzinsky has lost all its coxal vesicles, bears reduced vesicles with distinct retractor muscles on abdominal coxites II–IV (cf. Fig. 83).

The subgenus comprises actually a single well defined species, *M.* (*M.*) *aurantiacus* distributed in the western part of the USA. For the other described species of the subgenus, see the discussion under *M. aurantiacus.* The existence of other species of the subgenus seems possible. Wygodzinsky (1967: 509) has already stated that the different degrees of reduction make it impossible "to derive the recent South American species from the recent North American ones, but the reverse cannot be excluded." This conclusion is based on the supposition that the extreme reduction of parts or organs usually cannot be reversed on the same parts. But this would also mean that the descendence of North American species from the recent South American species group would be extremely improbable as it would require the reduction of the terminal spines on the abdominal stylets II and III to be reversed. There are two other possibilities besides this one. The ancestors of the two subgenera could have evolved separately from the primitive subgenus *Machilinus* or together from an extinct form, the reductions of which were not allowed to exceed the reductions of one of the derived subgenera (*Neotropolinus* and *Nearctolinus*). A decision in favor of one of these hypotheses could perhaps be made on the basis of additional collections and studies.



Figures 28–42. *Machilinus* (*Nearctolinus*) *a. aurantiacus* (Schoett). Figure 28. Head (male), frontal view. Figure 29. Apex of mandible (male) frontal view. Figure 30. Base of antenna (male). Figure 31. Maxillary palp (male), lateral view. Figure 32. Article 2, outer side. Figure 33. Articles 2 + 3, inner side. Figures 34–36. Labium partly, dorsal view. Figure 34. Male. Figure 35. Article 3 (male) with field of short setae. Figure 36. Female. Figure 37. Leg I (male). Figure 38. Leg III (male). Figures 39–41. Sternocoxite II (male), ventral view. Figure 39. Survey, d = inner distance of stylet bases. Figure

Material Examined.—See under *Machilinus aurantiacus.*

Machilinus (*Nearctolinus*) *aurantiacus* (Schoett), 1897

Machilis aurantiacus Schoett, 1897.

Types.—Neoholotype: male (see discussion); CALIFORNIA. *NAPA Cor.:* 3 km NE of Angwin, 396 m, 12 Jun 1980, H. B. Leech. Neoallotype: female; same data as neoholotype. Paratypes: 1 male, 1 female; same data as neoholotype; 1 female, same data as neoholotype except 20 Jun 1979 on garden soil; all types deposited in the California Academy of Sciences, San Francisco.

Redescription.—Small species (adults 6–8 mm); basic color of body and appendages yellow; brown hypodermal pigment widely distributed especially on head and its appendages but not clearly defined; black pigment present on chitinous cover of flagellum, tips of mandibulae and spine-like setae. Head (Figs. 28, 46): eyes very large (ratio width of head : width of eyes, 0.8–0.85), about as long as wide (ratio length of eye : width, 0.9–1.1); line of contact, 0.5–0.6 × length of eyes; lateral ocelli white to transparent, sublateral to eyes, elliptical to suboval; distance of inner margins 0.5–0.6 × width of both eyes; frons not protruding; pigment on frons and clypeus present but not clearly defined; hairs on clypeus of medium size; frons of male with short spine-like setae. Antennae (Fig. 30): shorter than body (up to 5 mm); ratio length of scapus : width, 1.6–1.9; distal chains of flagellum with up to eight subarticles, flagellum uniformly brown, scattered subcircular flat sense organs present (see Wygodzinsky 1950: 595–599). Mandibles (Fig. 29): distal end black with four distinct teeth. Maxillary palps (Figs. 31–33): distal spines of lacinia black; ratio length of articles seven : six : five, 0.45–0.55:1.0:1.0–1.1: 0.7–0.75 respectively; maximal number of spines on articles seven/six/five: 13/4/1; inner side of article two (male) with well developed hook and characteristic field of setae oriented differently, distal ventral margin with relatively short and strong darkly pigmented setae. Labal palps (Figs. 34–36): distal end of article three only slightly widened; sensory cones long and slender; male with field of short setae on median edge of dorsomedian side of article three; hairs on dorsal side of article two inclined up to 90° to longitudinal axis of article. Legs (Figs. 37, 38): coxal stylets absent; femora I distinctly wider than II and III; median (ventral) side of femur, tibia, tarsomeres with characteristic black spine-like setae, maximal numbers registered: 14/21/10/17/10 respectively; in legs III coxa also with up to four spine-like setae. Urosternites (Figs. 39–45): coxal vesicles I absent, on II–V one pair of reduced vesicles with adhering muscles present (reduction progressing distadly), on VI and VII vesicles or adhering muscles not discernible; sternites small (ratio length of sternites I–VII : length of coxites, 0.15–0.25; width of sternites I–VII : width of coxites, 0.2–0.3), median angle obtuse; well limited fields of setae on coxites laterad-distadly from base of stylets, number and length of setae decreasing from II to VIII; scattered long setae on all coxites, spine-like setae absent; terminal spines of stylets II and III well developed, slightly longer (II) or slightly shorter (III) than surrounding setae; stylets IV–IX with greatly reduced terminal spines (Figs. 43, 44); all stylets with many dark colored spine-like setae increasing distadly in number and length; lateral distance of inner stylet bases in II and III very small, approximately one-fourth of width of both coxites; ratio of distance between inner margins of stylet base II: III:IV, 1.0:1.0–1.1:1.9–2.1, on V–VIII distance continually decreasing. Ovipositor (Figs. 47–50): with 60 or more articles; terminal spines well developed, longer than the three terminal articles; distal articles with hyaline sensory rods or short setae, on gonapophyses VIII approximately seven/four/three/two (from distal), on IX approximately seven/three/one; number of setae on more proximal articles greatly reduced, on VIII one to three setae per article, on IX zero to one; setae on proximal one-half of gonapophyses very short or absent. Caudal appendages: filum terminale little longer than body; cerci longer than one-third body length; one terminal spine on cerci present; typical hair-like scales absent; longer scales in male and female present.

Diagnosis.—The species can be determined by the characteristics of the subgenus.

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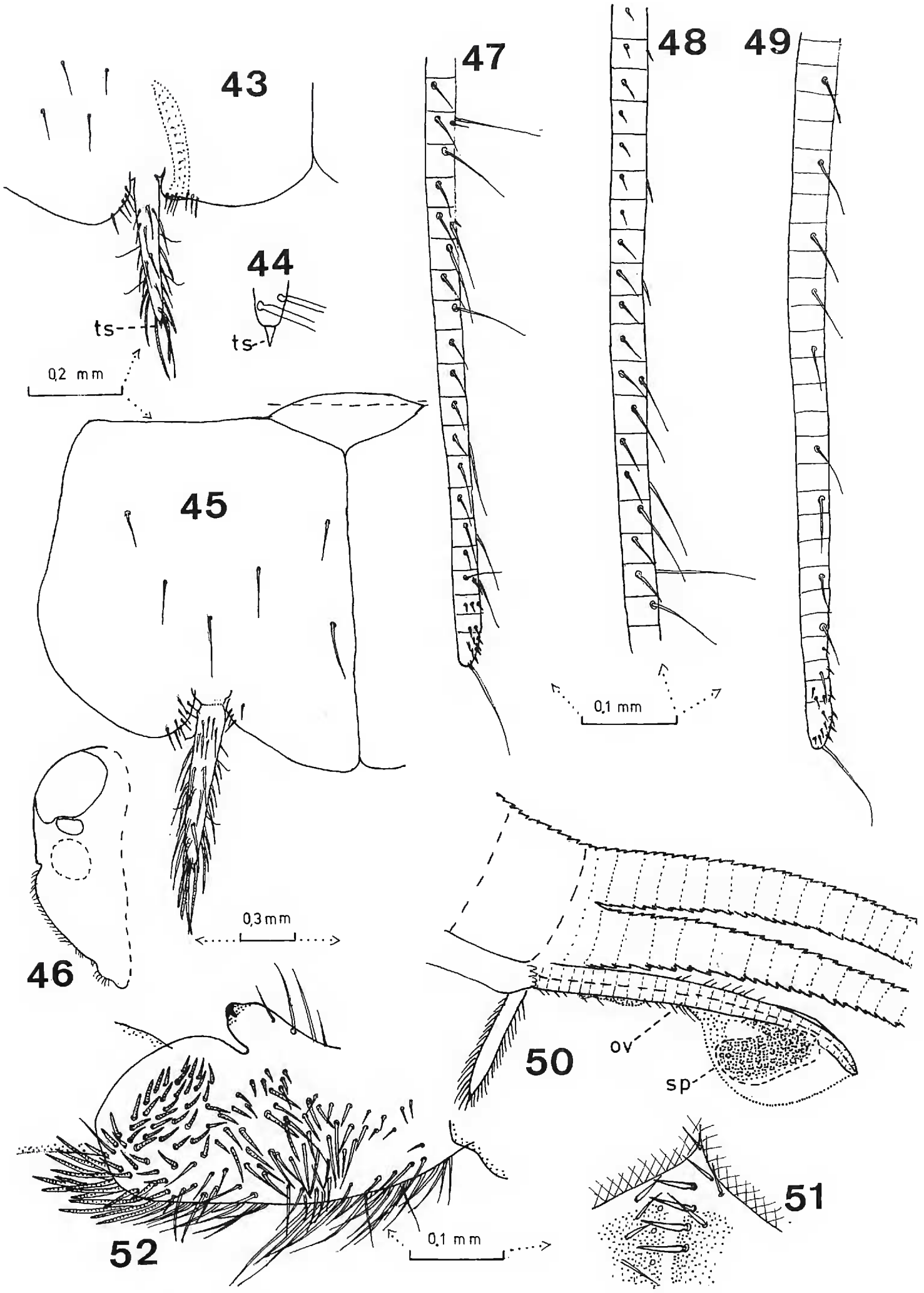
40. Distal portion of stylet. Figure 41. In part, with muscles for stylet (= ms) and coxal vesicle (= mc). Figure 42. Coxite IX with penis, ventral view.



Figures 43–52. Figures 43–50. *Machilinus* (*Nearctolinus*) *a. aurantiacus* (Schoett). Figures 43, 44. Stylet IV (female), partly, ventral view. Figure 43. Distal part of coxite with retractor muscle of reduced coxal vesicle, ts = terminal spine. Figure 44. Apex of stylet with reduced terminal spine (= ts). Figure 45. sternocoxite VIII (female), partly. Figure 46. Head (female), lateral view. Figures 47–49. Gonapophyses (female), ventral view. Figure 47. VIII, distal part. Figure 48. VIII, adjacent portion to Figure

Discussion.—The species *M. aurantiacus* was described by Schoett (1897) on the basis of specimens from the Sierra Nevada and Monterey, California. The description allows the genus to be recognized but mentions hardly any of the characteristics specific to the species, with the exception of the somewhat enigmatic details about coloration (pp. 188, 189): "The cerci are . . . dazzling white in color. . . . on each tergite are running 8–10 orange colored transverse lines." These statements could perhaps refer to alterations resulting from preservation. Silvestri (1911) used specimens from Shasta Springs, California and Boulder Canyon, Nevada for a redescription. In spite of many enquiries at American museums in an attempt to find the type material used by Schoett, it could not be found anywhere. It was probably deposited in the CASC-Museum and destroyed by a fire in 1911. There is no evidence of greater variations to be found in the extensive material which could justify the description of more than one species. The types of the second species described for North America, *M. nevadensis* Seetmann, 1937 could not be found either. The differences between *M. nevadensis* and *M. aurantiacus* mentioned by Sweetman result partly from the inadmissible comparison between color in living and fixed specimens, or from the the fact that Sweetman had only females at his disposal. Therefore, *M. nevadensis* must be regarded as a nomen nudum. The locality of the neotype lies between Monterey and Shasta Springs. Some light differences relating to the different length of specialized setae on article two of the male maxillary palp (Fig. 52) led to the description of a new subspecies.

A female from Sonora Pass had taken up a spermatophore (length 0.9 mm) that remained adhered to its ovipositor (Fig. 50). This reveals that in this genus there occurs a (probably indirect) transmission of spermatophores registered previously for *Machiloides tenuicornis* Stach, 1920 and *Neomachilellus scandens* Wygodzinsky, 1978, both from the same family (Sturm & Adis 1984, Sturm 1986). The spermatophore of *M. aurantiacus* shows a differentiated secret cover which is taken up together with the sperm and partially drawn out within the ovipositor. The formation of spermatophores by the males of *Machilinus* (*M.*) *rupestris gallicus* had already been assumed by Bitsch (1968) in the basis of studies on the inner sex organs.

The subgenus was collected only in the western part of North America. Fourteen of the 15 registered localities are in the USA (California [10], Nevada [2], Utah [1], Arizona [1]) and only one in Canada (British Columbia).

Material Examined.—ARIZONA. *COCHISE Co.:* Portal, 30 May 1967, C. Sabrocky, 5 females. CALIFORNIA. *CONTRA COSTA Co.:* 9.6 km (6 mi) W of Walnut Creek, 21 Oct 1967, L. N. Bell, 2 males, 1 female. *MARIN Co.:* Alpine Lake Valley, 24 Jun 1973, R. X. Schick, 1 female. *SONOMA Co.:* 3.2–4.8 km (2-3 mi) N of Sebastopol, 7–14 Jul 1963, P. Rubtzoff, 8 females. NEVADA. *NYE Co.:* Mercury, 6 Jul 1961–5 Aug 1962, 15 males, 43 females. CANADA. *BRITISH COLUMBIA.* Kamloops, 27 Oct 1929, O. Bryant, 1 female.

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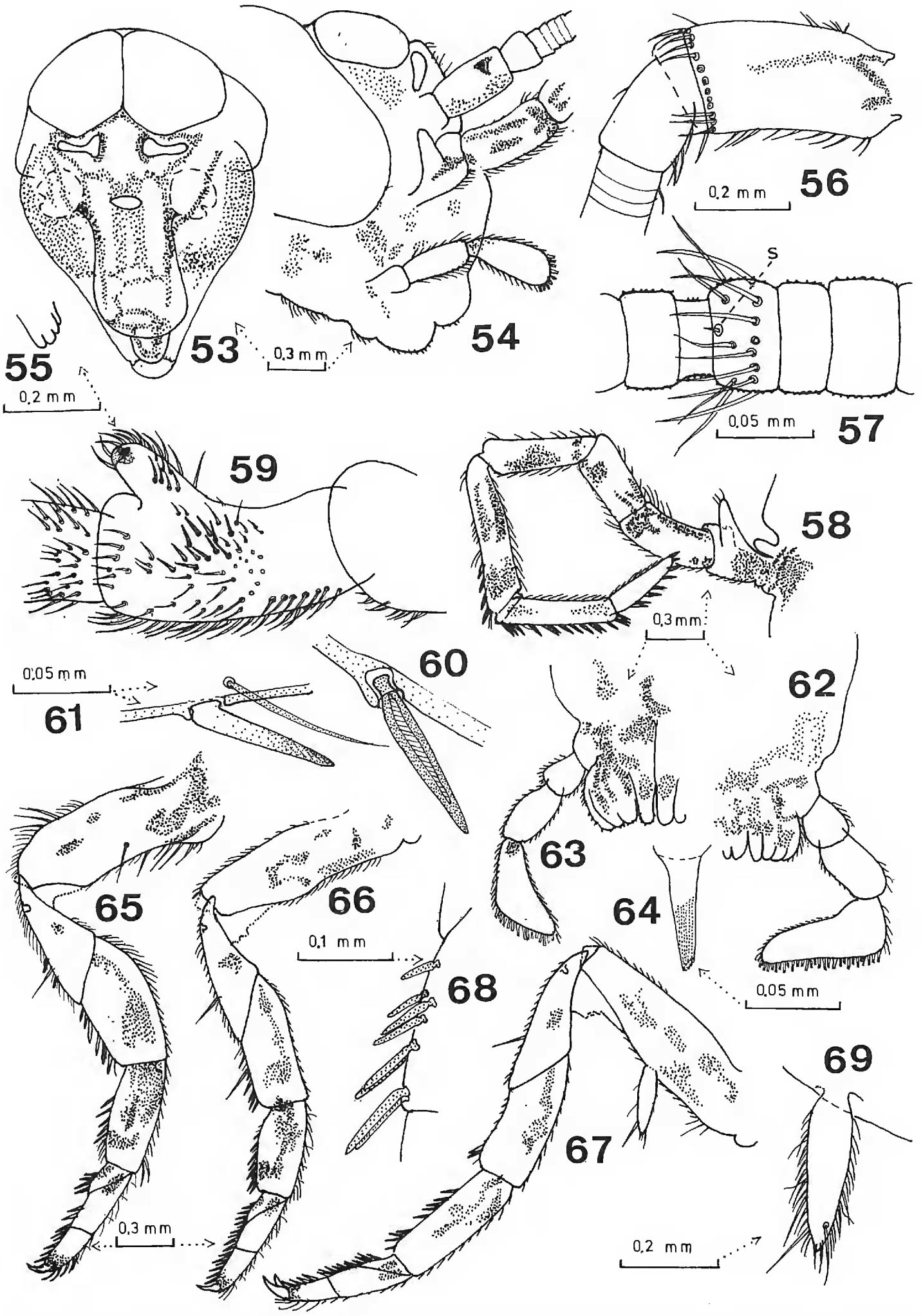
47. Figure 49. IX, distal part. Figure 50. Distal part of body (female), lateral view, ovipositor (= ov) with adhering spermatophore (= sp). Figures 51, 52. *Machilinus* (*Nearctolinus*) *aurantiacus setosus* NEW SUBSPECIES (male). Figure 51. Dorsal part of frons with spine-like setae, frontal view. Figure 52. Maxillary palp, lateral view, inner side.



Figures 53–69. Figures 53–60 and 62–69. *Praemachilellus rentzii* NEW SPECIES. Figure 53. Head (female), frontal view. Figure 54. Head (male) lateral view. Figure 55. Apex of mandible (female), frontal view. Figures 56, 57. Antenna (female). Figure 56. Base. Figure 57. Flagellum, apical article of a distal chain, s = sensory rod. Figures 58–60. Maxillary palp, lateral view. Figure 58. Survey (female). Figure 59. Article 2 (male), inner side. Figure 60. Spine-like seta on article V (female). Figure 61. *Machilinus* (*Neotropolinus*) *chilensis* NEW SPECIES, "spine" on article 5 (female). Figures 62–

Machilinus (*N.*) *aurantiacus setosus* Sturm & Bach, NEW SUBSPECIES (Figs. 51, 52)

Types.—Holotype: male; UTAH. 9 miles E of Oak City, Oak Camp. 1 Sep 1963, D. C. Rentz. Allotype: female; same data as holotype. Paratypes: 1 male, 1 female; CALIFORNIA. *TUOLUMNE Co.:* Chipmunk Flat near Sonora Pass, 19 Jul 1964, D. C. & K. A. Rentz. All types deposited in the California Academy of Sciences, San Francisco.

Description.—Spine-like setae on ventral-distal border of article two of male maxillary palp distinctly longer than in the nominate form, partly longer than one-third of median diameter of article (Fig. 52). Median part of frons in male with two rows of stout spine-like setae (Fig. 53). Hypodermal pigment of all coxae uniformly well developed on the surface. Area of short setae on labial palp article three of male more extended than in nominate form and reaching almost to outer margin.

Diagnosis.—The above differential characteristics of the subspecies are present only in the males. These show an obvious tendency towards an increased formation of long spine-like setae on article two of the male maxillary palps and of short ones on the median part of frons.

Discussion.—Because the chaetotaxy is not distinctly different from that of the nominate form, the form is ranked as a subspecies.

Etymology.—The subspecies is named after the big spine-like setae on maxillary palp article two and frons of male (setosus (latin) = bristly).

Material Examined.—See types.

Praemachilellus Sturm & Bach, NEW GENUS

Type Species.—*P. rentzii* Sturm & Bach, NEW SPECIES.

Description.—Head: dorsal part of frons distinctly protruded; eyes large, little longer than wide; lateral ocelli sole-shaped, inner distance smaller than width of one ocellus. Antennae: apparently shorter than body; distal articles of chains with scattered sensory rods. Mandible: apex distinctly four-toothed. Maxillary palps: longitudinal process on base well developed; triangular process on article one fairly digitate; articles five to seven with stout brown pigmented spine-like setae, typical spines absent, except for the terminal spine; article two of male with field of spine-like setae on inner side, with well developed hook on dorsal-distal margin. Labium: submentum near base of palps lateradly distinctly protruded; article one distinctly shorter than two; article three in female moderately, in male extremely widened. Legs: small coxal stylets on legs III only; femora I distinctly wider than II and III; ventral margin of all legs from femur distadly with dark spine-like setae. Urosternites: I–VII with one + one coxal vesicles, II–IX with stylets; terminal spines of stylets well developed, about one-fourth to one-third as long as stylets. Penis: shorter than one-half length of coxites IX; aperture triangular, inner border surrounded by small bulgy grooved setae. Ovipositor: of secondary type; relatively short, not extending beyond tips of coxites IX: distal articles of gonapophyses VIII each with transversal row of darkly pigmented strong setae, two distal articles of VIII with pigmented fossorial claws. Caudal appendages: typical hair-like scales absent; cerci with single terminal spine.

Diagnosis.—Besides the characteristic ovipositor the combination of the following characteristics can be used for the determination of the monotypic and well defined genus: Frons distinctly protruded; lateral ocelli sole-shaped, without

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64. Labium with palp, partly, ventral view. Figure 62. Male. Figure 63. Female. Figure 64. Sensory cone of labial palp article 3 (male). Figure 65. Leg I (female). Figure 66. Leg II (female). Figure 67. Leg III (female). Figure 68. Leg III (female), spine-like setae on tarsus 2. Figure 69. Leg III (female), coxal stylet.

obvious constriction in the median part; maxillary palps on articles five to seven with spine-like setae in the place of the usual spines; article one of labial palps distinctly shorter than article two; coxal stylets only on leg III; all legs with characteristic spine-like setae; aperture of penis with specialized grooved setae.

Etymology.—In some respects the genus is more primitive than the related genera *Machilellus* and especially *Neomachilellus*: prae (latin) = before.

Discussion.—Together with the genus *Kuschelochilis* Wygodzinsky, 1951 (Fig. 84), the new genus is the the only one within the Meinertellidae that has an ovipositor of secondary type. This shows that this feature, which is found extensively within the family Machilidae, either evolved separately in two different genus groups of Meinertellidae, or was not lost completely in the genotype of this family. The latter possibility seems more probable.

The presence of characteristic, straight and pigmented spine-like setae with a constriction near the base, on articles five to seven of the maxillary palps was apparently not described for Machiloidea up until now (Fig. 60). In other genera of Machiloidea these articles bear spines that are fastened with a broad base in the exocuticula. They are distinctly inclined on the basal part, surrounded at the base by a small cuticular ring and not clearly separated from the cuticula by a joint. Moreover, the spines are more securely attached to the exocuticula. Grooved setae around the aperture of penis are present in several genera of the Meinertellidae, highly specialized in *Neomachilellus* and *Meinertellus* (cf. Sturm 1984). A distinct feature of *Praemachilellus* is the much widened basal part of the setae and the fact that they are not arranged in distinct rows.

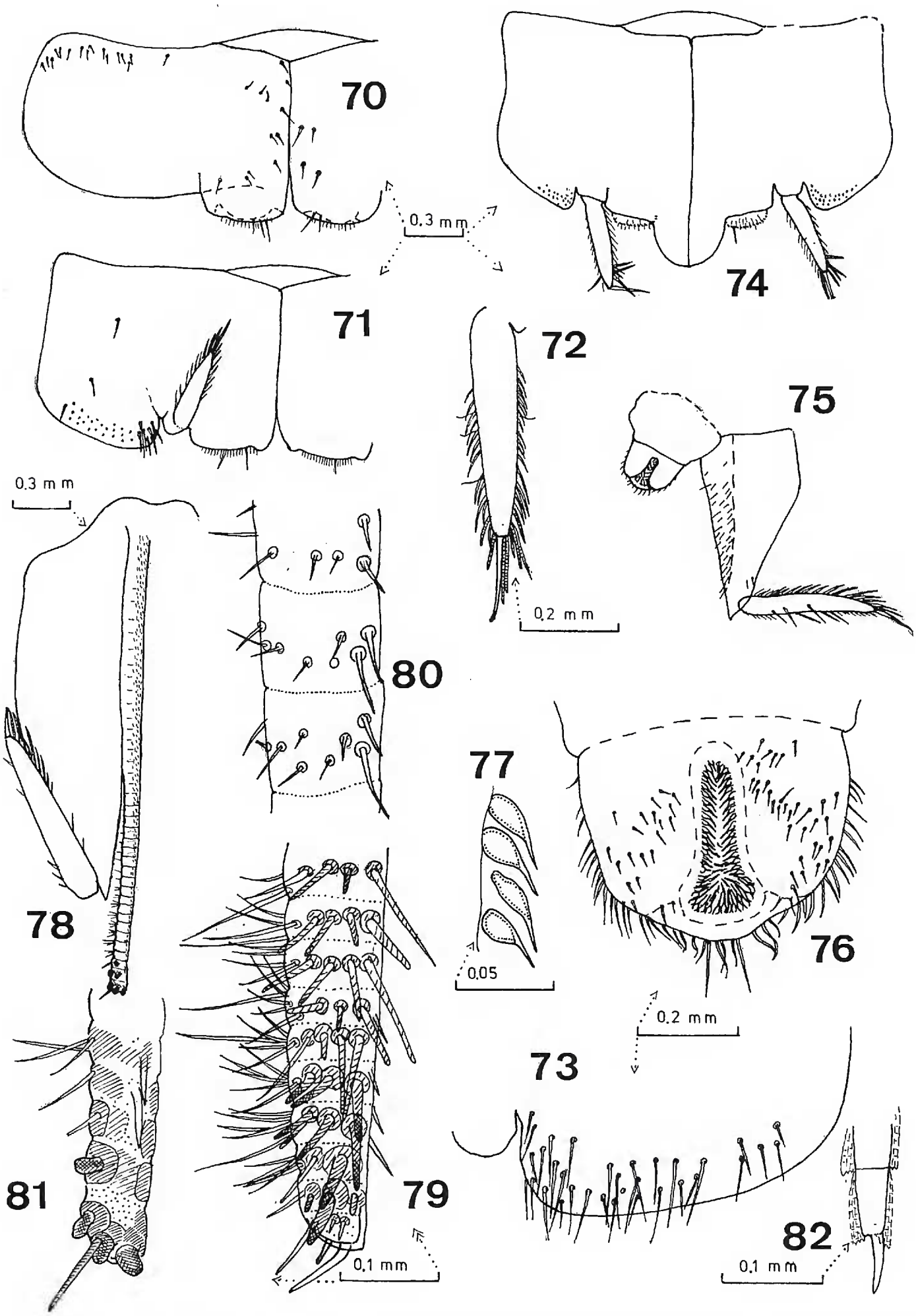
The presence of the ovipositor of secondary type and the presence of spine-like setae on the maxillary palps sets the genus apart within the Meinertellidae. The coxal stylets, only present on legs III, the pigmented spine-like setae on all legs, the obvious sexual dimorphism of the labial palps and the form and position of the lateral ocelli indicate that it is related to the genus *Hypomachiloides,* collected in Texas and Mexico. Distinct features of this genus are the ovipositor of primary type and the extreme sexual dimorphism of the labial palps (cf. Bach & Sturm 1988).

Material Examined.—See *P. rentzii.*

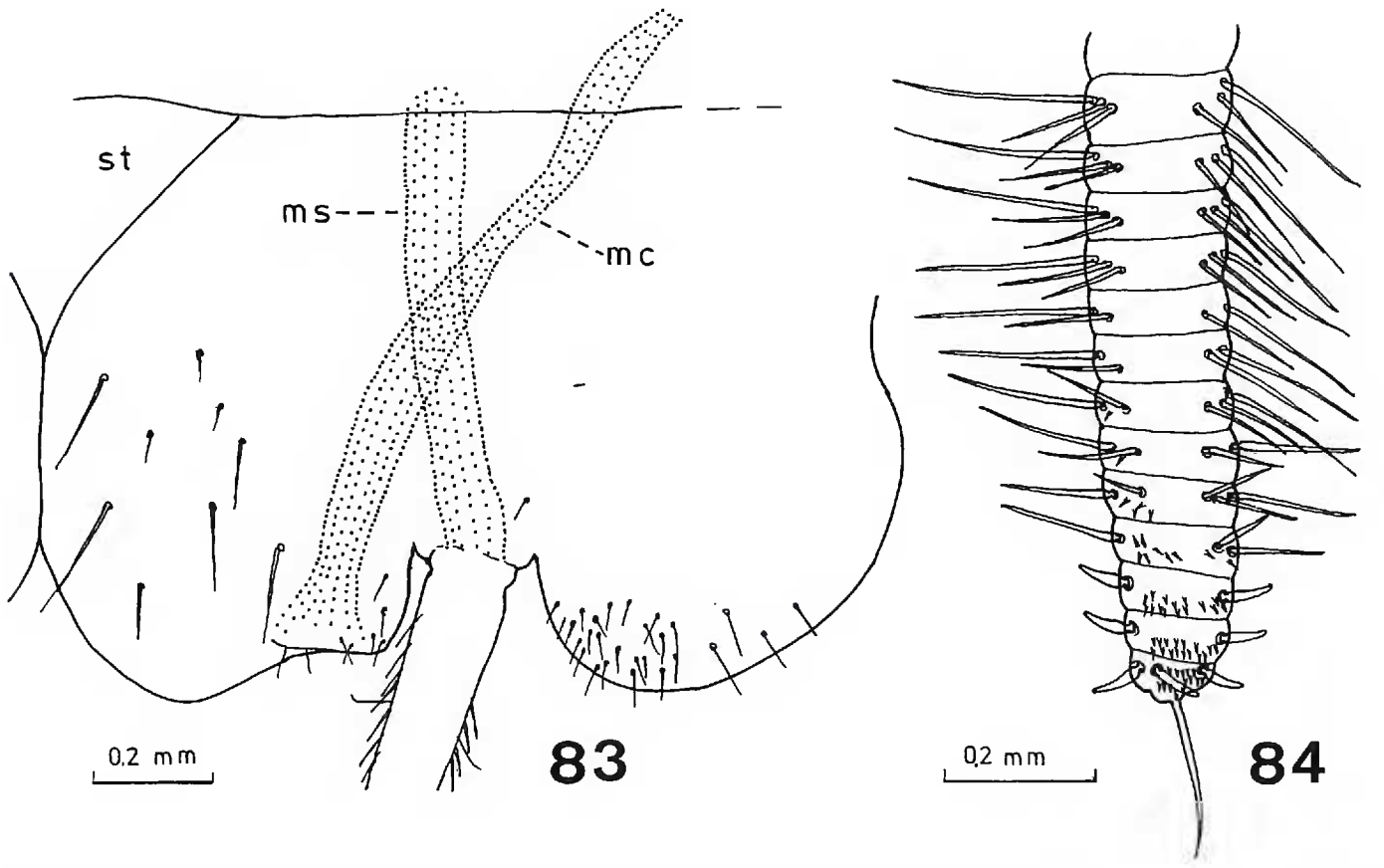
Praemachilellus rentzii Sturm & Bach, NEW SPECIES
(Figs. 53–82)

Types.—Holotype: male; MEXICO. *CHIHUAHUA:* 21.8 km (13 mi) N of Camargo, 1340 m, ex *Larrea tridentata,* 4 Sep 1968, D. C. & K. A. Rentz. Allotype: female; same data as holotype. Paratypes: 3 males, same data as holotype; 1 female; MEXICO. *DURANGO:* 8.0 km (5 mi) W of Cucname, ex *Larrea tridentata,* 29 Aug 1964, D. C. & K. A. Rentz. All types deposited in the California Academy of Sciences, San Francisco.

Description.—Medium sized (adults 7.5–9.5 mm); well defined patches of dark violet to brown pigment on head, head appendages and legs; pigment on all tergites and on abdominal coxites more diffusely distributed. Head (Figs. 53, 54): dorsal part of frons distinctly protruded; eyes large (width: 0.75–0.85 × head width) somewhat wider than long (ratio length : width, 0.75–0.92; line of contact, 0.5–0.7 × eye length); lateral ocelli red brown, submedian to eyes, sole-shaped, distance between inner margins smaller than width of one ocellus; frons between lateral ocelli with some strong setae; clypeus with medium sized setae, pigment pattern see Figs. 53, 54. Mandibles (Fig. 55): distinctly four-toothed;



Figures 70–82. *Praemachilellus rentzii* NEW SPECIES. Figures 70–74. Urosternites (female), ventral view. Figure 70. I. Figure 71. V. Figure 72. Stylet V. Figure 73. V, distal-lateral part. Figure 74. VIII. Figure 75. Coxite IX (male) with penis, ventral view. Figure 76. Penis, ventral view. Figure 77. Grooved setae from inner margin of penis aperture. Figure 78. Coxite IX (female) with gonapophysis. Figures 79, 80. Gonapophysis VIII (female), ventral view. Figure 79. Distal part. Figure 80. Articles 21–23, counted from caudal. Figure 81. Gonapophysis IX (female), apex. Figure 82. Apex of cercus (male) with terminal spine.



Figures 83, 84. *Kuschelochilis ochagaviae* Wygodzinsky, 1951, paratypes. Figure 83. Detail of urosternite II (male), mc = muscle of coxal vesicle, ms = muscle of stylet, s = sternite. Figure 84. Apex of gonapophysis VIII (female).

nearly all of surface heavily pigmented. Antennae (Figs. 56, 57): shorter than body length (up to 6 mm); scape with small pigmented patches only, ratio length : width, 1.6–1.9; flagellum uniformly brown, distal chains with nine subarticles, distal subarticles of each chain with scattered sensory cones. Maxillary palps (Figs. 58–60): longitudinal process near dorsal base well developed; triangular process on article one long and fairly digitate; articles five to seven with straight pigmented spine-like setae instead of the usual spines (Figs. 60, 61); ratio length of articles seven/six/five/four = 0.65–0.8:1.0: 1.25–1.4:0.95–1.25 respectively; maximal number of spine-like setae on articles seven to five: 19, 23, 10 respectively; for pigment pattern see Fig. 58; article two of male with well developed process on the dorsal distal margin ending in heavily chitinized hook and with field of stronger setae on inner face. Labium (Figs. 62–64): submentum near base of palps lateradly distinctly protruded; ratio length of articles one : two of palps, 0.6–0.7, article three in female moderately in male extremely widened. Legs (Figs. 65–69): small coxal stylets present only on legs III, ratio length of stylet : length of femur, 0.4–0.5; femur I distinctly wider than II and III; ventral side of femur and more distal articles of all legs with brown spine-like setae, maximal number on femur, tibia, and tarsomeres: 10, 18, 9, 10, 7 respectively. Urosternites (Figs. 70–75): I–VII with one + one coxal vesicles; terminal spines of stylets hyaline and rounded by darkly pigmented shorter setae; median distal margin of coxites VI (female) strongly protruded; ratio length of coxite : length of stylet : length of terminal spine for II, 1.6–1.7:1.0: 0.3–0.4; for V, 2–2.3:1.0:0.35–0.45; for VIII = 1.5–1.7:1.0:0.3–0.4; for IX = 1.7–1.9:1.0:0.25–0.35 (male), 1.9–2.4:1.0:0.2–0.3 (female); coxites II–VIII with fairly well limited field of setae near lateral base of stylets extending for most part lateradly; coxites IX (male) with stripe of setae near distal-median margin; spine-like setae absent. Penis (Figs. 76, 77): shorter than one-half length of coxite IX; aperture ventral, subtriangular, inner side rounded by densely inserted grooved setae with bulgy basal part and thin hair-like end; external surface with unspecialized setae. Ovipositor (Figs. 78–81): relatively short, not extending beyond tips of stylets IX, with about 32 articles; of secondary type; gonapophyses VIII with short lateradly oriented terminal spine; five most distal articles each with one to three very strong and blunt dark setae, proximadly follow transversal rows of transitorial and normal setae (up to eight per article), number and size reduced on proximal half; two distal articles of gonapophyses IX each with one to three fossorial claws, typical transitional setae absent from more proximal articles. Caudal appendages (Fig. 82): typical hair-like scales absent; terminal filament broken; length of cerci up to 3.4 mm (about 0.4 × body length); cerci with single terminal spine.

Diagnosis.—This is the only species of the genus and it can be determined and characterized by the characteristics of the genus.

Etymology.—The species is named after the collectors D. C. & K. A. Rentz[1] who consequently collected interesting material on Machiloidea.

Material Examined.—See types.

Acknowledgment

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[1] "K. A. Rentz" is now Kathleen Hale Sorensen.